# 3.4 Vegetation

## 3.4.1 Assumptions and Methodology of Analysis

The analysis area for vegetation is the general analysis area as described in FEIS Section 1.3. A key assumption for the analysis is that wildfires will continue to be suppressed in the West Bear Analysis area under the Wasatch Cache National Forests Fire Management Plan (USDA FS 2005) because of the developed nature of the landscape and the proximity of downwind private land and homes. Although wildfires can not always be immediately suppressed (the East Fork Fire that escaped initial suppression resulted in an outside fire perimeter of 14,000 acres), successful fire suppression over the years has resulted in changes in species composition, age class distribution, and down woody fuel loading.

The analysis method is to present the existing conditions of the forest vegetation, the process agents that affect them, and how the alternatives would affect these conditions and processes.

## 3.4.2 Existing Inventories, Monitoring, and Research Literature Review

A number of sources of information for vegetation conditions exist. They include the Forest Vegetation GIS layer (See Maps 10 and 11 in Appendix A), timber stand data from the Timber Inventory Management System, Interior West Forest Inventory and Analysis data, aerial insect and disease detection flights and maps, aerial photo interpretation, range monitoring data, and field reconnaissance for ground truthing of data, sensitive plants, and noxious weeds. Some of these same tools are used for monitoring. Monitoring is also conducted through remeasuring of established plots and photo points, and records of timber harvest. Research appropriate to the analysis is cited throughout the vegetation section.

## 3.4.3 Affected Environment

Approximately 69 percent of the analysis area is forested. Table 3.4.1 displays the number of acres by each forest cover type in the current landscape.

**Table 3.4.1. Forest Cover Types**

| Vegetation Type | Acres | % of Total Area |
|---|---|---|
| Lodgepole pine | 1,542 | 9 |
| Spruce/fir | 3,294 | 20 |
| Aspen | 616 | 4 |
| Mixed Conifer (MC) | 2,902 | 18 |
| Aspen/MC | 2,810 | 18 |
| Total Forest Cover Types | 11,164 | 69 |
| Sagebrush-grass | 4,412 | 27 |
| Tall Shrub | 293 | 1 |
| Wet Meadow | 207 | 1 |
| Barren | 96 | <1 |
| Water | 143 | <1 |
| Total Analysis Area | 16,315 | 100 |

## 3.4.3.1 Conifer Forest Types

The conifer forest types primarily affected by the proposed action are spruce/fir and mixed conifer (O'Dell 2005). Lodgepole pine will be treated where it occurs in mixed stands, but pure lodgepole stands are not proposed for treatment in this analysis. Three major forest types are within the analysis area, with several variations of each. The western half of the area (from Meadow and Humpy Creeks, to the ridge east of Whitney Reservoir) is primarily spruce/fir. From the ridge east to approximately Mill City Creek the primary forest type is mixed conifer, comprised of lodgepole pine, Engelmann spruce and subalpine fir. However, in the Coyote Hollow and Road Hollow areas, pure stands of lodgepole pine occur at lower elevations adjacent and just south of the Whitney Road. The eastern quarter is a combination of mixed conifer and aspen/conifer stands. The discussion below summarizes the condition of these stands in the analysis area.

**Lodgepole Pine**

Lodgepole pine is not considered a climax species in this landscape. It generally occurs in association with other species, and is a prominent component of mixed conifer stands. Relatively pure stands occur in the Coyote Hollow and Road Hollow areas, appearing as even-aged, single-storied stands, with or without an understory of spruce and fir. Stands are generally mature, with an average age of 80 to 100 years.

Lodgepole pine is a pioneer species which regenerates prolifically after stand-replacing fires. Where fire frequency is less than 150-200 years subalpine fir may be excluded and lodgepole pine will occur in pure stands. When lodgepole pine regenerates after fire it frequently seeds in so heavily that the resultant stand stagnates at a young age. Because stagnated lodgepole stands do not experience heavy self-induced mortality, they may persist in this condition for 70 years or more. Stagnated patches of pole-sized (2 to 6" diameter) lodgepole occur throughout the mixed conifer type, but extensive areas of stagnated stands are generally absent.

Table 3.4.2 displays the stand data from a single stand in the Coyote Hollow area. Age is shown as the average age of overstory trees (greater than 7") and the oldest tree sampled in the stand. The high basal area (249 square feet) and average diameter of 9.2 inches indicate a high level of susceptibility to mountain pine beetle mortality. Table 3.4.2 also illustrates the shift in composition toward more late seral stages, with the increased percentage of fir in the lower size classes.

**Table 3.4.2. Stand Composition – Lodgepole pine.**

| Drainage | Trees per Acre by Size Class | | | | Basal Area per Acre by Size Class | | Average Diameter by Size Class | | Average Species % | | | | | | | | Avg. Age | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | All Trees | | | | Trees >7" | | | | >7" | Max. Rec. |
| | Seed. | 0-.9 in. | 1 – 6.9 in. | 7 – 36+ | 1 – 6.9 | 7 – 36+ | 1 – 6.9 | 7 – 36+ | Subalpine fir | Spruce | Aspen | Lodgepole | Subalpine fir | Spruce | Aspen | Lodgepole | | |
| Coyote Hollow | 0 | 60 | 1004 | 225 | 145 | 104 | 5.2 | 9.2 | 33 | 0 | 10 | 57 | 0 | 0 | 0 | 225 | 83 | 95 |

**Spruce/Fir**

This type represents a climax condition in the West Fork Bear River landscape and is found in both even-aged (one or two age classes) and uneven-aged (three or more age classes) stands. Spruce-fir stands in the analysis area are mature and old, with stand ages exceeding 150 years. Trees tend to be large and dense, with diameters of the overstory trees (those greater than 7") averaging over 12", and basal areas greater than 150 square feet per acre. The West Bear Ecosystem Management Project (USDA FS 2002) indicated the spruce-fir forest was outside the historic range of variation. In the long term, and in the absence of disturbance, subalpine fir may become more dominant. However, there are two schools of thought on this and neither is definitive. Research (Veblen 1986) indicates that because spruce is longer-lived than subalpine fir, it may continue to dominate a stand until a stand replacing event such as a large wildfire occurs. It is unlikely that spruce would not maintain some presence in stands where they are currently dominant or codominant. In systems with high fuel loading such as the spruce-fir in the West Bear

analysis area, allowing any fire to burn involves the risk of a large stand replacing fire, given fairly rapid changes in weather that can occur. Most small fires can effectively be suppressed. Beetle outbreaks can also be suppressed in the early stages. The Forest Service is not always successful in suppressing fires that escape initial attack with heavy fuel loading and hot, dry, windy weather. The Forest Service is also not successful in suppressing bark beetle infestations once they are more than just small pockets of beetle infestation. Suppression of small fires and beetle outbreaks reduces the disturbance processes on the landscape. Without these disturbances it is likely that over a long period of time these stands could shift toward more predominance of subalpine fir (Steen et al. 2005). It will take a long period of time to complete all of the group selection entries needed to achieve an uneven aged stand of spruce-fir.

Keane et al. (2002) cites authors that the last 70 to 80 years of fire suppression have not had much influence on subalpine landscapes with fire intervals of 200 to several hundred years but there have been recent shifts in forest stand ages to older age classes. Fire exclusion effects in long fire interval fire regimes, such as those in lodgepole pine and spruce fir, are not yet manifest at the stand level, but are detectable at the landscape level. They mentioned young age classes are often missing from subalpine landscapes where fires have been excluded. The well substantiated relationship of reduced forest health due to fire exclusion in ecosystems characterized by high fire return intervals (for example, low-elevation ponderosa pine woodlands) cannot be applied to all mesic subalpine ecosystems with long fire return intervals. But despite these exceptions, the Rocky Mountain landscape, taken as a whole, is not burning at the pre-1900 rate. In spruce-fir forests of Colorado, spruce beetle (*Dendroctonus rufipennis*) outbreaks do not affect young (less than 80 years) postfire stands, which implies that long-term fire exclusion in the subalpine zone eventually would result in increased beetle activity as a larger portion of the landscape enters old-growth stages. Veblen (2003) found that the fire regime of the spruce-fir cover type in northern Colorado is characterized by infrequent, crown fires that burn large areas. High severity fires resulting in spruce-fir stands of high tree densities are part of the natural fire regimes of this ecosystem type. Although late seral stands with heavy fuel loading in spruce-fir are not uncharacteristic, the effects of a fire may not be desirable in a landscape being managed for multiple uses. About 19% of the spruce-fir type has reduced fuel loading due to past silvicultural treatments (EIS Tables 3.4.1and 3.4.7). The remaining 81% is in late seral stages with usually heavy fuel loading. Fire suppression is likely to continue on this landscape. (See EIS Section 3.5.1). The adverse effects of escaped wildfire in the spruce-fir type with heavy fuel loading at a landscape scale are evident in the recent (2002) East Fork Fire (USDA FS 2004c). All of the spruce in large patches were killed by the fire, leaving very little seed source. Very little spruce regeneration in this fire has been observed to date. Although the spruce-fir stands in West Bear are probably not outside the range of variation, a very large percentage of the spruce-fir at the landscape level is susceptible to stand replacing fire during drought cycles. A literature review by Keane et al. (2002) displays stand level and landscape effects of fire exclusion. At the landscape level a decrease in early seral communities, increased landscape homogeneity, increase in dominance of one patch type, and decreased patch diversity occurs along with larger and more severe fires, increase in crown fires, increased insect and disease epidemics, and increased contagion resulting in more severe insect and disease epidemics. Silvicultural systems can replace some of the effects of fire in landscapes where wildfires are not acceptable and where fire cannot be safely prescribed.

Data collected from 5 stands in Meadow Creek, 4 stands in Humpy Creek and 5 stands east of Whitney Reservoir in early fall of 2001 are summarized below (Table 3.4.3). These data were extracted from stand tables on file in the Evanston Ranger District. The data indicate that the spruce component (PIEN) comprises 24 and 16 percent of all trees in the stand, respectively, with subalpine fir (ABLA) the majority species. It is interesting to note that the overstory (trees larger than 7" dbh) contains a much higher proportion of spruce. Of the 13 stands, only 2 have less than 40% spruce in the overstory. However, when the smaller diameter trees and seedlings are included, only 2 stands have 25% or more spruce. This indicates that the majority of the existing regeneration is subalpine fir.

**Table 3.4.3. Stand Composition – Spruce/fir.**

| Drainage | Trees /Acre by Size Class | | | | Basal Area/Acre by Size Class | | Average Diameter. By Size Class | | Average Species % | | | | Avg. Age | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | All Trees | | Trees >7" | | >7" | Max. Rec. |
| | Seed. | 0 - .9 in. | 1 – 6.9 in. | 7 – 36+ | 1 – 6.9 | 7 – 36+ | 1 – 6.9 | 7 – 36+ | ABLA | PIEN | ABLA | PIEN | | |
| Humpy | 1295 | 32 | 105 | 113 | 5 | 174 | 2.8 | 17.2 | 84 | 16 | 40 | 60 | 155 | 295 |
| Meadow | 0 | 635 | 343 | 171 | 15 | 157 | 3.0 | 13.1 | 79 | 24 | 42 | 58 | 101 | 281 |
| E. Whitney | 0 | 1045 | 557 | 126 | 24 | 133 | 3.0 | 14.0 | 89 | 5 | 57 | 35 | 111 | 154 |

ABLA=Subalpine Fir; PIEN=Engelmann Spruce

**Mixed Conifer**

The mixed conifer type generally represents stands that are in a mid-seral successional stage, containing both seral species (aspen and lodgepole pine) and climax species (spruce and fir). Uninterrupted by natural disturbance or active management, these stands will succeed to the more tolerant climax species. The majority of mixed conifer stands are in the mature and old age classes; stand ages average over 100 years, with individual trees exceeding 150 years. Species composition varies considerably throughout the type, but stands generally have a mix of spruce, fir and lodgepole pine, with species dominance most likely determined by disturbance history of the stand. Individual patches within a stand may be composed of spruce-fir, nearly pure lodgepole pine, or a balanced mix of species. Subalpine fir and spruce will tend to dominate mixed stands in the absence of disturbance, while lodgepole will dominate stands that have received disturbance in the past. Elevation also plays a role in stand composition, with spruce and fir common in the higher elevation stands and lodgepole pine more common in the lower to mid elevations. Regardless of the overstory composition, the shade tolerant subalpine fir is the dominant understory species.

Table 3.4.4 presents average stand data from 3 stands in the Coyote Hollow – Road Hollow area. The data for trees greater than 7" indicates the mixed composition of these stands, with a good representation of lodgepole pine (PICO) and relatively small aspen component (POTR). Individual stand composition varies considerably within the mixed conifer cover type, with the dominant species alternating between lodgepole pine, Engelmann spruce and subalpine fir. As with the spruce/fir type, the majority species of regeneration and small trees is fir. The high basal areas (averaging 227 sq. ft.) are well above the threshold for beetle susceptibility, and mortality of lodgepole pine due to mountain pine beetles is increasing throughout the mixed conifer cover type.

**Table 3.4.4. Stand Composition – Mixed Conifer.**

| Drainage | Trees /Acre by Size Class | | | | Basal Area/Acre by Size Class | | Average Diameter. By Size Class | | Average Species % | | | | | | | | Avg. Age | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | All Trees | | | | Trees >7" | | | | >7" | Max. Rec. |
| | Seed. | 0 - .9 in. | 1 – 6.9 in. | 7 – 36+ | 1 – 6.9 | 7 – 36+ | 1 – 6.9 | 7 – 36+ | ABLA | PIEN | POTR | PICO | ABLA | PIEN | POTR | PICO | | |
| Coyote – Road Hollow | 0 | 446 | 542 | 200 | 58 | 169 | 4.6 | 12.2 | 74 | 18 | 1 | 8 | 48 | 38 | 3 | 11 | 103 | 156 |

ABLA=Subalpine Fir; PIEN=Engelmann Spruce; POTR=Aspen; PICO=lodgepole pine

## 3.4.3.2 Aspen and Aspen/Mixed Conifer Forest Types

Aspen and aspen/mixed conifer stands are common in the eastern third of the analysis area, primarily from Mill City Creek east to Hwy 150.

**Aspen**

Aspen is an early seral species and seldom occurs as a climax species at these elevations. On the lower elevations of the Uinta Mountains, typically off-forest, aspen appears to be a climax species where understories are dominated by

common juniper (*Juniperus communis*). Fire history is the likely cause where aspen appears to be the indicated climax. Aspen is a fire-adapted species that suckers profusely after fire. Frequent fires will favor aspen over conifers, which much recolonize by seed. Successful sexual reproduction of western aspen is extremely rare. Therefore, unlike other western tree species, aspen once lost from the landscape generally will not reestablish from seed in the Intermountain West (Bartos 2001). The seed source for conifers may be entirely destroyed when large areas are burned over, making reinvasion extremely slow. Historically, fires began in the sagebrush and burned up into the aspen stands where more moisture and cooler temperature would stop the fires advancement. These fires occurred frequently enough to remove the seed source for all of the conifer species. Very few acres of pure aspen are found within the analysis area, but they occur north of the analysis area on private lands. The majority of aspen within the West Bear analysis area occurs as aspen/mixed conifer.

Where pure stands of aspen occur, retention of overstory trees during treatment will reduce the number of aspen suckers. This is due to the hormonal balance between the roots and the crown and the fact that essentially all of the aspen in the stand is connected to other aspen through root grafts. Partial removal of the overstory will inhibit sprouting adjacent to the residual overstory trees. However, in large, older aspen stands the degree of grafting is reduced; in these situations, partial removal may not inhibit sprouting.

**Aspen/Mixed Conifer**

These mixed stands are early to mid-seral and occur over much of this landscape. Aspen succeeding to conifers are responding to natural forces. Aspen is considered a disturbance species perpetuated on site by fire, disease, or other such occurrences. Some of these forces (primarily fire) have been altered by human intervention, which has given shade-tolerant conifers a marked advantage (Bartos 2001). Aspen comprises between 1/3 and ½ of the overstory trees, sharing dominance with lodgepole pine, Engelmann spruce, and subalpine fir. Aspen is generally 60 or more years old and has existed with conifers for the life of the stand. In the absence of disturbance, fir has become established in the understory so that it now is the primary understory species.

The aspen/mixed conifer type presents a good opportunity for prescribed fire use in combination with harvest to create the desired future. Conifer limbs and tops can be retained following timber harvest to provide fuel for subsequent prescribed burning. Cutting submerchantable conifers prior to burning can create additional fuel. This treatment allows for creating a mosaic of aspen structures with grass/forb aspen developing where adequate fuel to carry fire exists. It is also easier to ensure a controlled burn that will not escape by providing fuels that will burn under moderate burning conditions. Shepperd (2001) stated that fire meets all of the requirements of the aspen regeneration triangle. It stimulates suckering by killing overstory stems and by killing near surface root segments and thereby interrupting the flow of auxin to surviving downstream root segments. Fire removes competing understory vegetation and conifer seedlings, and it allows sunlight to reach the forest floor. The vegetation consumed by the fire provides a nutrient pulse for new suckers and the blackened surface warms soil in the root zone, further stimulating sucker growth. Dense suckering over large burned areas can act as a deterrent to browsing animals.

Using fire as a primary regeneration tool in aspen forests requires the availability of fuels and acceptance of the risk that accompanies the uncertainty of applying treatment. It is usually difficult to get a fire to carry through a pure aspen stand, even in the understory. Burning mixed aspen/conifer stands to regenerate aspen brings risks associated with an overabundance of fuels. Shepperd concluded that one means of mitigating this risk is to use prescribed fire as a secondary or site preparation tool in conjunction with harvest or mechanical manipulation to remove excess biomass. Fuels can be manipulated by the initial treatment to allow safe and effective burning later. Combining fire with other manipulation treatments can greatly benefit the aspen regeneration triangle, maximize suckering, and closely mimic natural fire disturbance cycles in mixed aspen/conifer ecosystems. In a cooperative study of the use of prescribed fire in combination with the harvest of competing overstory conifers on the Coconino National Forest in Arizona, a prescribed burn fueled by scattered logging slash stimulated much more suckering than did the removal of competing overstory conifers alone.

Table 3.4.5 displays the results from 5 stands between Mill City Creek and Hwy 150 that were examined in the fall of 2001. A disparity between the overstory and understory composition similar to that in the spruce/fir and mixed conifer types can be seen here. Fir is again the dominant regeneration species, indicating ongoing succession toward later seral species, with the potential loss of much of the aspen component.

**Table 3.4.5. Stand Composition – Aspen/Mixed Conifer.**

| Drainage | Trees /Acre by Size Class | | | | Basal Area/Acre by Size Class | | Average Diameter. By Size Class | | Average Species % | | | | | | | | Avg. Age | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | All Trees | | | | Trees >7" | | | | >7" | Max. Rec. |
| | Seed. | 0 - .9 in. | 1 – 6.9 in. | 7 – 36+ | 1 – 6.9 | 7 – 36+ | 1 – 6.9 | 7 – 36+ | ABLA | PIEN | POTR | PICO | ABLA | PIEN | POTR | PICO | | |
| Mill City Creek | 4480 | 23 | 544 | 276 | 42 | 150 | 4.1 | 10.2 | 67 | 0 | 19 | 14 | 14 | 2 | 34 | 50 | 103 | 156 |

ABLA=Subalpine Fir; PIEN=Engelmann Spruce; POTR=Aspen; PICO=lodgepole pine

## 3.4.3.3 Past Disturbance

Timber harvesting in the analysis area began in the mid nineteenth century and has continued to the present. The Hilliard Flume and Lumber Company constructed 36 miles of flume between 1847 and 1875 to move logs from the mountains to the charcoal kilns at Hilliard. The flume originated east of Mill City Creek, and there was a camp located along Mill City Creek consisting of a company store, bunkhouses and houses that serviced up to 500 workers. Evidence of old logging is also found west of Whitney Reservoir, which appears to have occurred about 100 years ago. More recently, logging in the 1960s and 1970s harvested in the lodgepole and spruce/fir stands in the Gold Hill and Coyote Hollow areas. Extensive personal-use fuelwood cutting in the area has resulted in the removal of most snags near roads.

**Lodgepole Pine**

Approximately 231 acres of lodgepole pine were clearcut between 1966 and 1973. The Deer Creek fire burned about 141 acres in 1980. Thinning is about ⅔ completed on the 245 acres in the Coyote Road Hollow Sale. With the exception of a small area in the Deer Creek fire, these stands have successfully regenerated to lodgepole pine.

**Table 3.4.6 Lodgepole Pine Harvest**

| Sale Name | Year | Harvest | Acres |
|---|---|---|---|
| Gold Hill | 1966-1973 | Clearcut | 58 |
| Unknown | 1972 | Clearcut | 42 |
| Whitney Road | 1917 | Clearcut | 17 |
| Fat Chance | 1973 | Clearcut | 114 |
| Deer Creek Fire | 1980 | Fire | 141 |
| Coyote Road | Ongoing | Thinning | 245 |

**Spruce/Fir**

Evidence of historic timber harvest indicates some of the earliest logging occurred at about the turn of the century. Old, decaying Engelmann spruce stumps can be found in the Meadow Creek area. Judging from the state of decomposition and the size of the adjacent trees it is estimated that the harvest occurred about 100 years ago. The harvesting most typified a selection harvest and accounts for the origin of one age class in the stand. The most recent harvest activity focused on a spruce beetle outbreak in the Meadow Creek and Humpy Creek drainages. About 512 acres were harvested, concentrating on dead, dying, and high-risk trees. Combinations of shelterwood and selection harvest methods were employed, depending upon initial stand conditions. To ensure regeneration, the harvested area had spruce spot planted throughout the harvest area in 1993-1995. Spruce and fir regeneration is progressing quickly in these recently selectively harvested units. Numerous spruce and fir seedlings are now present where mineral soil was exposed and gaps were created in the canopy. Seedlings and saplings that were present in the understory prior to the harvest are now beginning to grow more rapidly.

From 1968 to 1973 approximately 98 acres were harvested in the Pass Creek area, using a clearcut prescription, followed by piling and burning of the slash. Creating large openings and removal of the down woody material created harsh site conditions that inhibited regeneration. Planting and natural regeneration have increased the tree

occupancy to the point where they now are approaching minimal stocking, and the individual trees are growing well. These stands continue to progress toward full stocking and will eventually develop into a fully forested condition. These stands were originally spruce/fir but have been classified as mixed conifer on current vegetation maps due to regeneration of lodgepole pine as well as spruce and fir. Examination of such stands has made it clear that the proper method of management in spruce/fir is small group (1/4 to 1/2 acre in size) and single-tree selection, which will provide the protection for developing seedlings, and perpetuate an uneven-aged condition.

**Table 3.4.7 Spruce/fir Harvest**

| Sale Name | Year | Harvest | Acres |
|---|---|---|---|
| Pass Creek | 1965-1968 | Clearcut | 98 |
| Meadow and Humpy Creeks | 1995 | Salvage | 512 |
| Total | | | 610 |

**Mixed Conifer**

In the 1950's approximately 172 acres were selectively harvested, clearcut, or burned directly to the south of Gold Hill in the Hayden Fork drainage. In a true selection harvest a maximum tree diameter, a predetermined distribution of size classes and a residual stocking level is specified. The 1950s harvest was probably more product oriented, where trees that would provide the product were harvested, and those that did not were left.

**Table 3.4.8 Mixed Conifer Harvest**

| Sale Name | Year | Harvest | Acres |
|---|---|---|---|
| Unknown | 1956-1964 | Selection | 93 |
| Unknown | 1956 | Clearcut | 44 |
| Gold Hill Fire | 1956 | Fire | 35 |
| Gold Hill | 1996 | Clearcut | 3 |
| Whitney North | 1993 | Clearcut | 22 |
| Whitney South | 1994 | Selection | 125 |
| Total | | | 322 |

**Aspen/Conifer**

In 1982 and the 1990s, small sales were harvested within the aspen/conifer type. The individual stands were lodgepole pine dominated stands with a substantial proportion of aspen scattered throughout. The stands were clearcut with the objective of restoring aspen through sprouting. Table 3.4.9 displays those sales. One of the 1982 Aspen sale units is within West Bear drainage; the others are within the Hayden Fork drainage.

**Table 3.4.9 Aspen/Conifer Harvest**

| Sale Name | Year | Harvest | Acres |
|---|---|---|---|
| Aspen | 1982 | Clearcut | 11 |
| Aspen | 1990 | Clearcut | 11 |
| Gold Hill #1 | 1996 | Clearcut | 14 |
| Gold Hill #2 | 1994 | Clearcut | 16 |
| Gold Hill #3 | 1994 | Clearcut | 36 |
| Total | | | 88 |

Table 3.4.10 displays the harvest and fire disturbance that has occurred or is planned in the analysis area in the last 60 years.

**Table 3.4.10. Disturbance by Decade.**

| Watershed | Decade | | | | | | Total |
|---|---|---|---|---|---|---|---|
| | 1951-1960 | 1961-1970 | 1971-1980 | 1981-1990 | 1991-2000 | 2001-2004 | |
| West Fork Bear River | | | | | | | |
| Clearcut | | 98 | 173 | 3 | 25 | | 299 |
| Selection | | | | | 637 | 245* | 882 |
| Fire | | | 141 | | | | 141 |
| Hayden Fork | | | | | | | |
| Clearcut | 44 | 19 | 39 | 19 | 66 | | 187 |
| Selection | 60 | 33 | | | | | 93 |
| Fire | 35 | | | | | | 35 |
| Totals | 139 | 150 | 294 | 22 | 728 | 245* | 1637 |

*Thinning in pine beetle infested stands – under contract in 2005.

## 3.4.3.4 Old Forest

Guidance within the Revised Forest Plan and the West Bear Ecosystem Analysis has a goal for maintaining or restoring 40% of total conifer and 30% of total aspen cover types in mature and old age classes, well distributed across the landscape under the Forest Plan (USDA FS 2003, pp. 4-19, 4-40). Guideline G14 contains a table with desired structure and pattern for forest cover types including 20% composition of mature forest and 20% composition of old forest. Standard S13 states, "at least 20 percent of each forested cover type by ecological section shall be maintained with old forest landscape structure with patch sizes of at least 10 acres. These old forest areas are dynamic, changing location as disturbances occur" (USDA FS 2003, p. 4-39).

**Analysis Area**

Of the 11,164-forested acres within the analysis area, 1,742 or approximately 15% are in early to mid-seral stages. The remaining 85% are mature and old (stand age greater than 100 years). Tables 3.4.2 through 3.4.5 display the ages of the stands sampled within the analysis area. The average age as well as the maximum recorded age in the stand is shown in the last two columns. The maximum recorded age is not necessarily the oldest tree in the stand; it represents the average of the oldest trees actually measured on each plot.

Stand characteristics of the mature and old classes varies considerably between the forest cover types. In the lodgepole pine type, stands tend toward even-aged, single-storied structure; for example, tree ages range from 70 to 95 years, with an average of 83 years. These stands tend to have little down woody material and relatively few snags per acre (although that is changing rapidly with the current mountain pine beetle infestation).

Spruce/fir and mixed conifer stands average between 100 and 200 years old. However, the overstory trees tend toward much greater ages, with individual large overstory trees attaining ages well over 200 years. These stands tend toward several age classes, basal areas exceeding 150 square feet per acre, with significant down woody material and several snags per acre.

Characterizing Aspen/Conifer stands within the analysis area is more problematic than the other cover types. These stands vary from patches of conifers interspersed in aspen stands to stands with a relatively even mix of conifers and aspen, to aspen dominated stands with relatively widely scattered conifers. In general these stands average 93 years old, ranging from 86 to 105 years (stand age is the age of the conifer component). They mostly have a large component of subalpine fir seedlings and saplings. Snag density and down woody material varies considerably; however, the recent mountain pine beetle infestation has greatly increased lodgepole snag density.

**Ecological Section**

The West Bear Vegetation Management Project is located within the Uinta Mountains Ecological Section (USDA FS 2003b, p.3-66). An estimation of the amount of old forest was derived from examination of stands within the project area and Interior West Forest Inventory and Analysis (FIA) plots (USDA FS 2005d). FIA plots are located on a grid across the forest and consist of permanently established field plots distributed at a sample intensity of

about one plot per 6,000 acres. Each plot consists of a cluster of four subplots spread out over about 2.5 acres. Most data are related to the tree and understory vegetation components of the forest and are used for comprehensive assessments and analysis of forest resources. These analyses include status and trends in the extent, condition, health, and uses of forests. Data also are used for an assessment of forest composition and structure at the landscape scale; and their relation to habitat conditions, susceptibility to insects and disease, and response to disturbance.

In preparation for Forest Plan revision, additional FIA plots were established on the Forest, providing a sample intensity of about one plot per 3,000 acres. One hundred sixty plots are located across the Evanston, Mountain View and Kamas Districts on the North Slope of the Uinta Mountains. Analysis of data from the plots located within the Forest Plan mapped vegetation types was used to determine stand age and estimate the aerial extent of the mature and old age classes across the North Slope. FIA data used in this analysis was collected in 1993 and are the most recent data available. With the exception of the East Fork Fire in 2002, there have been very limited disturbances between 1993 and the present.

The Forest Plan FEIS defines old conifer forest as greater than 150 years old (USDA FS 2003b, p. B1-3). Stand age refers to the origin of the stand, rather than average age of the trees within the stand. For example, an uneven-aged that originated following disturbance 200 years ago will contain several age classes, from old overstory trees to young seedlings. A stand age estimated by taking the average of all classes will not represent the actual length of time the stand has existed, since the younger trees will skew the data toward a younger age. Therefore, using the age of the oldest trees on the plot more accurately reflects the condition of the stand. It was estimated that if a stand had at least 10 trees per acre that were at least 150 years old, that stand met the Forest Plan definition of old forest. FIA data was queried for the percent of plots that met that criterion by forest type. The total acres of old stands by Forest Type are displayed in Table 3.4.11.

**Table 3.4.11. Old Forest by Cover Type within the Uinta Mountains Ecological Section.** *FIA 1993 data less acres burned and harvested since 1993.*

| Wasatch-Cache Forest Type | Ecosection Forest Type Acres | Old Forest Acres from FIA Data | Area Harvested or Burned 1993-2005 | Remaining Old Forest Acres | Percent of Area in Old Forest |
|---|---|---|---|---|---|
| Non-Wilderness Douglas-fir | 8,511 | 7,064 | 10 | 7,054 | 83 |
| Non-Wilderness Lodgepole Pine | 51,343 | 24,131 | 2,118 | 22,013 | 43 |
| Non-Wilderness Mixed Conifer | 112,301 | 48,289 | 2,717 | 45,592 | 41 |
| Non-Wilderness Spruce/fir | 61,858 | 24,743 | 1,032 | 23,711 | 38 |
| Non-Wilderness All Conifers | 234,013 | 104,227 | 5,877 | 98,370 | 42 |
| Wilderness Lodgepole Pine | 1,534 | NA | 0 | NA | NA |
| Wilderness Mixed Conifer | 26,957 | NA | 0 | NA | NA |
| Wilderness Spruce/fir | 62,898 | 56,608 | 0 | 56,608 | 90 |
| Wilderness Spruce/fir and Mixed Conifer | 89,855 | 70,985 | 0 | 70,985 | 79 |
| All Conifer Types | 325,402 | 175,212 | 5,877 | 169,355 | 52 |

NA: Not enough plots for a valid sample were taken in these forest cover types. However, subtracting acres of Wilderness Spruce/fir from combined Wilderness Spruce/fir and Mixed Conifer provides an estimate of 14,377 acres of Wilderness Mixed Conifer.

### 3.4.3.5 Noxious Weeds

Transportation into the project area of weed seeds has the potential to increase noxious weed populations that do not exist there presently. Transport can also occur within the project area, from currently infested areas to non-infested areas. Transport on vehicles, clothing or animals are all mechanisms for noxious weed dispersal into new habitats. For this reason, noxious weed invasions due to timber harvest and burning activities are a primary concern.

*Cardaria draba* (whitetop), *Carduus nutans* (musk thistle), *Cirsium arvense* (Canada thistle), *Isatis tinctora* (Dyers woad), and *Centaurea maculosa* (spotted knapweed) have all been found growing within the West Bear analysis area. Of these, musk thistle, Canada thistle and spotted knapweed have been recorded near, although not within, some of the proposed harvest units. All of these weeds disperse seed primarily by wind.

### 3.4.3.6 Threatened, Endangered and Sensitive Plant Species

The West Fork Bear project area includes habitat for *Cypripedium fasciculatum* (Brownie lady's slipper), a Forest Service sensitive plant species. A survey in 2005 identified a single specimen of this species in an area proposed for treatment. This area along with a suitable buffer has been removed from the proposed treatment area. *Cypripedium* within the Uinta Mountains has been found in pure lodgepole stands at lower elevations, and in mixed conifer (lodgepole-spruce-fir) stands at upper elevations. It is now known that the species, once thought to be limited in habitat to lower elevation sites in the Uinta Mountains, can occur throughout this project area. Potentially affected species at risk, identified within the analysis area (but not in the project area or in any harvest units) are presented in Table 3.4.12.

**Table 3.4.12. Potential Species-at-Risk within the West Bear Analysis Area.**

| Botanical Name | Common Name | Status | Habitat |
|---|---|---|---|
| *Penstemon uintahensis* | Uintah Beardtongue | WCNF Watch List | Spruce-fir and alpine tundra at 10,498-12,516 feet elev. |
| *Parrya rydbergii* | Naked Stemmed Wallflower | WCNF Watch List | Perennial found in alpine tundra – rock and talus at high elev. |
| *Draba globosa* | Rockcress draba | FS Sensitive | Perennial in alpine tundra, talus or alpine meadows |
| *Ivesia utahensis* | Utah Ivesia | WCNF Recommended Sensitive | Alpine tundra and krummholz, often in talus at 10,496-11808 feet elev. |
| *Papaver radicatum* | Alpine poppy | WCNF Watch List | Talus slopes and rock at 10596-12007 feet elev. |
| *Cirsium eatonii var. murdockii* | Murdocks thistle | WCNF Watch List | Talus slopes and rock stripes at 10597 - 12007 feet. |
| *Artemisia norvegica* var. *piceetorum* | Spruce wormwood | WCNF Recommended Sensitive List | Upper elevation Engelmann spruce. |
| *Astragalus flexuosus var. flexuosus* | Bent milkvetch | WCNF Watch List | Sagebrush openings |

### 3.4.3.7 Insects and Disease

The primary insects affecting stands within the West Bear Analysis Area are bark beetles belonging to the genus *Dendroctonus,* specifically the mountain pine beetle *(D. ponderosae)* and the spruce beetle *(D. rufipennis).* Both species are native to the area, and at endemic levels may beneficially remove older, weaker individuals from stand of trees, causing less than 2% mortality per year (Samman and Logan 2000). The effects of endemic mortality can invigorate plant communities; open canopies let in more light and allow rain to reach the forest floor; and insects produce very large amounts of nutrient rich material that falls as litter (Schowalter and Withgott 2001).

Although bark beetle outbreaks are important in the ecological development of a forest landscape, tree mortality because of an epidemic may exceed desirable levels, affecting multiple resource objectives including timber, wildlife, and recreation. Locally intense outbreaks can affect management decisions and detract from the many resource and social amenities realized from forested ecosystems (Samman and Logan 2000).

**Lodgepole pine**

The lodgepole stands within the analysis area have reached a diameter and density threshold that makes them susceptible to mountain pine beetles. The risk of a high level of mortality increases with stand conditions that include average diameter greater than 8 inches, stand age greater than 80 years, and stand basal area of 120 square

feet or more (Samman and Logan 2000). In larger, continuous stands, beetle outbreaks can result in 80 percent or more mortality over a 5 to 7 year period. Table 3.4.2 displays the stand data from a single stand in the Coyote Hollow area. The high basal area (249 sq. ft.) and average diameter of 9.2 inches indicate a high level of susceptibility to mountain pine beetle mortality. Table 3.4.2 also illustrates the shift in composition toward more late seral stages, with the increased percentage of fir in the lower size classes.

Mountain pine beetle activity has been increasing over the last two to three years, most likely exacerbated by the continuing drought conditions. Heavy infestation has occurred in the Coyote Hollow and Road Hollow areas, in relatively pure stands of lodgepole pine. Aerial detection surveys in the summer of 2004 detected many groups of insect killed trees, identified by the presence of red foliage in the crowns. However, on-the-ground examination of these same stands revealed the extent of the infestation to be much greater than estimated from the air. Many additional trees had been heavily attacked, but the crowns had not begun to turn red at the time of the survey. A small sale has been prepared in the Coyote/Road Hollow pine stands to treat approximately 240 acres. The harvest treatment will salvage the dead and infested trees and thin the remaining stand. The objective of this treatment is to limit the mortality to the already affected area and limit further spread of the beetles.

**Photo 3.4.1. Mountain Pine Beetles Attacked and Killed this Lodgepole Pine.** Anti-aggregative pheromone (an odor emitted by bark beetles that have successfully attacked a tree to prevent competition from to many other beetles) packets were placed on this tree in a campground on the Kamas District to protect it from beetle attacks. The nearby infestation of beetles was too heavy to prevent mass attacks as evidenced by numerous light colored pitch tubes around and below the pheromone packets.

Dwarf-mistletoe is a major pathogen in lodgepole pine stands, causing growth loss and increasing susceptibility to other diseases. Because the lodgepole pine in this community type occurs primarily as even-aged stands, the spread of the disease is mainly laterally. Lateral spread generally is slow due to the trajectory of the mistletoe seeds.

However, there are several old harvest units in this community type with regeneration that is highly susceptible to the disease. Past logging and fire left small, scattered islands of larger trees within the unit and along the edges. The islands and edges have some level of mistletoe, which provides infection sources distributed along and throughout the unit, thereby increasing the potential exposure of seedlings to dwarf mistletoe seeds.

**Spruce-fir**

Spruce bark beetles attack large, over-mature spruce that occur in either dense, relatively pure stands or mixed stands dominated by Engelmann spruce. At endemic population levels scattered individuals or small groups of trees are killed regularly, with wind thrown spruce being a prime breeding site. A catastrophic event, such as extensive blowdown, must occur to elevate a population of this beetle to epidemic proportions. When an epidemic does occur, mortality can be extensive and cause a shift in the species composition of the stand. For example, in a 20,000-acre area of spruce on the Manti-La Sal National Forest, 73 percent of the spruce trees greater than 5 inches in diameter were killed over a period of about 5 to 7 years, with a 47 percent decline in the spruce component (Samman and Logan 2000). In the West Bear analysis area, subalpine fir is the primary understory species. Mortality of the spruce would provide conditions conducive to rapid growth of the understory fir. In the Intermountain Region, mineral soil has been shown to be the optimum condition for spruce regeneration, while decayed wood the natural forest floor and undisturbed duff were poor seedbeds (Alexander 1987). The much greater abundance of subcanopy trees of subalpine fir implies more frequent recruitment into the canopy. Veblen (1986) found that subalpine fir accounted for 74.5% of the potential successors in the 125 treefall gaps sampled in seven old-growth unlogged stands in the Colorado Front Range. However, its greater recruitment rate into the canopy is approximately balanced by its greater loss from the canopy; even though subalpine fir accounted for only 37% of the canopy trees it accounted for 76% of the fallen trees. He postulates that the consistently lower frequency of Engelmann spruce as treefalls and its greater longevity compared to subalpine fir imply a lower adult mortality rate for the spruce. Consequently, the greater proportion of young subalpine fir does not imply that it will gradually replace Engelmann spruce in old-growth stands unaffected by large-scale exongenous disturbance. Spruce-fir forests have been described as either equilibrium or nonequilibrium systems (Aplet et al. 1988). In the equilibrium coexistence model, spruce and fir constitute a stable, climax community through balanced life history strategies. Nonequilibrium coexistence relies on periodic catastrophic disturbance to disrupt competitive exclusion of spruce by fir. Neither of these models, taken alone, adequately explains the range of stand behavior observed in Colorado spruce-fir forests. Instead, stand development appears to involve processes from both models. The stands they investigated are undergoing postfire development and, therefore, support the nonequilibrium model, but a successful spruce cohort late in stand development insures the continued presence of both species, as predicted by the equilibrium model. Rebertus et al. (1992) determined that despite numerous publications, there are very few detailed age structure analyses in old growth spruce-fir forests. In the harsh subalpine environment, slight differences in site may result in major differences in stand development patterns, and ultimately in the characteristics of old growth. It is clear that some very high-quality old-growth stands are in a transition old growth stage, and some of the structural attributes of the forest may change significantly in the next few hundred years. Additional studies also are needed to monitor (or extract dendrochronologically) the patterns of mortality in old growth over longer periods. There is a general idea of how stands develop into old growth, but only a vague notion of what happens thereafter. The susceptibility of old-growth stands to fire, beetle outbreak, and blowdowns still brings into question whether any spruce-fir stands can persist for a thousand years. A study in British Columbia (Steen et al. 2005) indicated that due to the dense cover of low shrubs and the great abundance of fir stems in the subcanopy of study stands, spruce establishment and survival would likely continue to be suppressed in the canopy gaps. A larger stand-level disturbance, resulting in mortality of several canopy and subcanopy fir stems, as well as reduced cover of low shrubs, will likely be required to maintain current spruce representation in the upper canopy. Alternatively, stand and patch-initiating disturbances such as wildfire and timber harvesting should re-establish the long-term role of spruce in the canopy.

As dead trees fall to the ground they create extremely high concentrations of fuel that can increase fire intensity and perhaps contribute to fire spread leading to large, stand replacing fires. What species will appear after the fire will depend on what seed sources are available. In the absence of associated species, regeneration may be delayed for one or more decades.

All of the spruce stands within the analysis area are susceptible to varying degrees to spruce beetle attack. Susceptibility is based on physiographic location, tree diameter, basal area, and percentage of spruce in the canopy. Spruce stands which have an average dbh of 16 inches or more, have a basal area greater than 150 sq. ft. per acre

and have more than 65 percent spruce in the canopy are the highest risk (Holsten et al. 1999; Schmid and Frye 1976). A small epidemic occurred in the Meadow and Humpy creek areas in the early 1990's. A blowdown initiated this epidemic, which covers about 400 acres and at one time was seeing annual mortality of over 1000 trees. Suppression efforts described by Bentz and Munson (2000) were employed and were successful in controlling the outbreak.

**Photo 3.4.2 Beetle Killed Spruce Around Butterfly Lake, About 10 Miles South of the West Bear Analysis Area.** Most of the remaining green trees are subalpine fir or lodgepole pine.

**Photo 3.4.3. Spruce Killed by Spruce Beetles About 3 Years Before the Photo Below was Taken.** Spruce begin to change from green to yellow one year after the beetles infest the tree.

**Photo 3.4.4. Natural Control of Spruce Beetles.** Bark Beetles are always present in the forest with populations usually maintained at endemic levels. Vigorous, healthy spruce trees are able to pitch beetles out. A spruce bark beetle that has been pitched out is visible on the lower side of the pitch tube below. At low endemic levels of bark beetles, woodpeckers prey on them and help to keep their populations low.

While western balsam bark beetle activity is common throughout the area, it is seldom of much consequence. After an extended drought period, however, high levels of subalpine fir mortality can occur. The dead trees allow for gap phase replacement by subalpine fir and Engelmann spruce. The drought conditions through the 1990's have predisposed many acres of subalpine fir to attack by the western balsam bark beetle. Thousands of trees were killed during the 10-year cycle. Unlike spruce beetles, which kill large groups of trees, this beetle killed individual or small groups of trees. Generally, subalpine fir regeneration is filling the gaps created by the mortality of the larger trees, although occasional spruce seedlings are found where mineral soil has been exposed. Existing saplings of fir and spruce, which existed in the understory as suppressed trees, are also being released by the death of the overstory.

**Mixed Conifer**

The effects of beetle activity would tend to be less severe in mixed conifer stands because of the species diversity. Bark beetles are host-specific; spruce beetles do not attack lodgepole pine, and mountain pine beetles do no attack Engelmann spruce. Therefore, increased beetle activity would tend to result in a compositional shift away from the species attacked, rather than large-scale mortality of the stand. However, the individual species within the stand remain susceptible to the beetles in the event of population increases, such as are occurring within the West Bear analysis area now.

Dwarf-mistletoe, although present in lodgepole pine, is a minor concern in the mixed conifer type due to the heterogeneity of the stand. The overstory lodgepole pine may be infected with the disease, but spread to other lodgepole pine is slowed by the presence of non-host species such as spruce and fir, which create a physical barrier to mistletoe seed transmission. When stand replacing fires occur, much of the mistletoe is destroyed.

## 3.4.4 Environmental Consequences

This section describes the potential effects of timber harvest, road construction, and prescribed fire including the direct, indirect, and cumulative effects for each alternative on movement toward properly functioning condition, insect predation, noxious weeds, old forest, and threatened, endangered and sensitive species. The analysis area for these effects on vegetation resources is the general analysis area. It is expanded from the general analysis area to include the entire Hayden Fork drainage for fire regime condition class under movement toward properly functioning condition (FEIS Section 3.4.4.1). The method of analysis is a description and an assessment of the likelihood of the direct and indirect effects of sedimentation on vegetation resources and their cumulative effects in combination with past, ongoing, and reasonably foreseeable future actions.

### 3.4.4.1 Movement Toward Properly Functioning Condition

#### Alternative 1 – No Action

Alternative 1 would have no direct effect on movement toward properly functioning condition (PFC). Stands would remain in their current conditions unless affected by unplanned disturbance such as insects, fire or windthrow. Wildfire suppression would continue on the landscape but the potential for an escaped fire would gradually increase due to increases in fuel loading over time. Allowing wildfires to burn in this area was determined to be unacceptable under the Wasatch-Cache Antennal Forest Wildland Fire Use Plan due to downwind private property. Spruce-fir and mixed conifer stands are heavily skewed toward mature and old age classes. The Wasatch-Cache Forest Plan has desired landscape structure for spruce-fir and mixed conifer of about 40% in mature and old age classes with the remaining age classes in grass/forb, seedling/sapling, young forest and mid-aged forest. About 93 % of the spruce-fir and mixed conifer in the West Bear landscape is currently mature and old. Most of the lodgepole pine in the landscape is currently mature and old and is presently being threatened by a heavy mountain pine beetle infestation. The Forest Plan has a desired landscape structure of 30% old aspen forest with 40% in grass/forb and seedling/sapling age classes and, 30% in young, mid-aged, and mature forests. Only 3% of the aspen in the West Bear landscape is currently in the grass/forb and seedling sapling age classes.

An indirect effect of Alternative 1 would be continued mortality from mountain pine beetle in the mixed conifer and aspen/conifer types, and spruce beetle in the spruce-fir forest type. If the current level of mountain pine beetle activity continues or increases, significant mortality would be expected, resulting in a possible shift of species composition toward subalpine fir, and a gradual increase in fuel loadings as the beetle-killed trees fall. The increased fuel loadings would increase the level of severity and the resistance to control in the event of a future wildfire in extreme fire weather conditions. In the spruce-fir type, this could result in large stand replacement fires due to similar conditions at an ecosection scale. Spruce-fir stands burned under these conditions may take several decades to regenerate naturally, due to the hot, dry site conditions following the burn and loss of seed sources.

Increased fuel loadings could have positive benefits to PFC in the mixed conifer type and aspen/conifer types if a wildfire escaped initial attack suppression or wildland fire use were allowed in the future. Increased fuels could promote stand replacing fires which would in turn reduce the amount of fir regeneration and provide favorable conditions for early seral species such as aspen and lodgepole pine. This would reduce the amount of late seral stage forest and increase the early (grass/forb and seedling/sapling) age classes. Patch sizes would be determined by burning conditions and fuels, and may approximate historical patterns.

#### Alternative 2 – Proposed Action

Alternative 2 begins to develop stands toward PFC. It creates small openings totaling approximately 200 acres in the spruce-fir and mixed conifer old forest, regenerating grass/forb and seedling/sapling age classes in small patches. This is equal to 20% of the treated acres or about 3% of the spruce-fir and mixed conifer acres within the analysis area. This alternative also maintains the large tree character of the present forest. Thinning would reduce the bark beetle hazard ratings over 802 acres, although the stands remain at risk in the event of an epidemic.

In terms of fire regime condition class (FRCC), thinning, in combination with the gaps created by the group selection units will increase the amount of late seral open stands by 14%, with a corresponding reduction in late seral closed. This thinning will reduce the bark beetle risk from high to moderate in treated portions of the stand (Schmid and Frye 1976), possibly allowing time for future entries that would continue to move the stand toward PFC before catastrophic stand replacement occurred. However, the stand will be a mosaic of late seral closed and late seral open, because much of the stand will remain unthinned to maintain the large tree character.

Alternative 2 also reduces conifer encroachment and treats aspen on 523 acres through a combination of harvest and prescribed burning. A prescribed fire with harvest and slash creation is estimated to be 80% effective, creating approximately 418 acres of aspen regeneration with an additional 40 acres aspen regeneration resulting from removal of conifer patches from aspen stands. This is equal to approximately 13% of the aspen/conifer in the analysis area.

**Cumulative Effects**

The regeneration of approximately 200 acres of the spruce-fir and mixed conifer forest into grass/forb, seedling/sapling age would reduce the acres of mature spruce-fir and mixed conifer acres within the analysis area to 5,996, and increase the early seral stage to approximately 298 acres (current activity plus 98 existing acres in Pass Creek area). About 10 % of the spruce-fir and mixed conifer in the West Bear landscape would be in younger age classes. Creation of 458 acres of aspen regeneration in addition to the 88 acres previously treated would result in 556 acres of aspen regeneration, equal to approximately 16% of the mixed conifer/aspen and aspen in the analysis area. The fire regime condition class (FRCC) for the forested area is currently at the high end of "moderately departed" considering past harvest and fires. Alternative 2 would have a minor cumulative effect of reducing the departure from 66% to 65% in the West Bear watershed and from 65% to 62% in the Hayden Fork watershed (FEIS Table 3.5.8). Roads and firelines are necessary to provide access and firebreaks. These are narrow corridors that result in minor fragmentation of the forest. However, the firelines and most of the roads are temporary and will therefore result in only temporary fragmentation. The 0.9 miles of intermittent service road under Alternative 2 would be closed to public use and seeded following timber harvest and would therefore have less fragmentation effect than an open road. The landscape structure would still not be balanced for any of the forest cover types as described under Forest Plan Guideline (G14) to manage vegetation for properly functioning condition at the landscape scale. The landscape structure would remain skewed toward mature and old forest with less than desired in the grass/forb, seedling/sapling, young, and mid-aged forest. There is a heavy infestation of mountain pine beetles in progress in the lodgepole pine in the analysis area. The Coyote Road Hollow Sale is thinning much of the lodgepole pine dominated component. Lodgepole pine is also being infested in the mixed conifer forest, which will result in some openings larger than 2 acres and a reduced percentage of lodgepole pine in the thinned areas. Spruce beetles are currently endemic throughout the area. If spruce beetle infestations or an epidemic were to develop, there would be a reduction in representation of spruce in the overstory of spruce-fir and mixed conifer stands and buildup of large down woody fuels especially in untreated areas. There are no cumulative effects with grazing since no range lands are being treated.

## Alternative 3

Alternative 3 also begins to develop stands toward PFC. It creates small openings totaling approximately 20% of the mature and old classes into the grass/forb and seedling/sapling classes on the treated acres, although it prescribes treatment on fewer acres (148 acres). Thinning will reduce bark beetle hazard ratings of the stands, although the stands remain at risk in the event of an epidemic.

Alternative 3 also reduces conifer encroachment and regenerates aspen through prescribed burning. Although Alternative 3 treats a similar number of aspen/conifer acres as Alternative 2, it is anticipated that fewer acres will be successfully burned due to the absence of slash to carry the fire. A prescribed fire without harvest and slash creation is estimated to be 40% effective, creating approximately 209 acres of aspen regeneration with an additional 32 acres of aspen regeneration resulting from removal of conifer patches from aspen stands. This is equal to approximately 7% of the aspen/conifer in the analysis area.

FRCC effects will be similar to Alternative 2 except they will occur on fewer acres. Approximately 10% of the analysis area acreage will move from late seral closed to late seral open.

**Cumulative Effects**

The regeneration of approximately 148 acres of the spruce-fir and mixed conifer forest into grass/forb, seedling/sapling age would reduce the acres of mature spruce-fir and mixed conifer acres within the analysis area to 6,038, and increase the early seral stage to approximately 246 acres (current activity plus 98 existing acres in Pass Creek area). About 9% of the spruce-fir and mixed conifer in the West Bear landscape would be in younger age classes. Creation of 241 acres of aspen regeneration in addition to the 88 acres previously treated would result in 329 acres of aspen regeneration, equal to approximately 10% of the mixed conifer/aspen in the analysis area. Roads and firelines are necessary to provide access and firebreaks. These are narrow corridors that result in minor fragmentation of the forest. However, the firelines and the roads are temporary and will therefore result in only temporary fragmentation. Alternative 3 would also have a minor cumulative effect of reducing the departure from 66% to 65% in the West Bear watershed and from 65% to 62% in the Hayden Fork watershed (FEIS Table 3.5.8). Effects on properly functioning condition at the landscape scale would be similar to those under Alternative 2 except that the skew toward older forest structure would remain higher.

## 3.4.4.2 Insect Predation (Mountain Pine and Spruce Beetles)

### Alternative 1 – No Action

Alternative 1 would have no direct effect on current beetle infestations or the forest's susceptibility to future outbreaks. The high basal areas, average diameters and proportion of spruce and lodgepole pine provide the necessary stand conditions suitable to sustain a beetle epidemic.

An indirect effect of Alternative 1 would be a shift in species composition and structure, at least in the short term, toward fir and, where aspen is present, mixed aspen and fir stands to replace the dead lodgepole pine and spruce. If a spruce beetle or mountain pine beetle outbreak were to occur, the primary response of vegetation to this scale and intensity of disturbance is the establishment of new stands (Oliver 1981; Veblen et al. 1991). This type of disturbance serves to reduce competition and increase nutrient availability resulting in the accelerated growth of understory plants and subcanopy trees (Veblen et al. 1991). The understory and subcanopy trees within the project area are primarily subalpine fir. There is uncertainty over whether or not spruce canopy composition in spruce-fir forests is significantly affected in the long term as described in FEIS Section 3.4.3.7. A large scale disturbance of this magnitude would affect the large tree character component of the existing forest. This effect would be greatest in the spruce-fir forest type, and somewhat less in the mixed conifer, due to the species diversity of the latter type. The loss of the large tree characteristic would have detrimental effects on other forest resources, such as visuals, recreation and wildlife habitat. Based on the beetle susceptible forest that currently exists and the mortality associated with other beetle epidemics within Utah, the majority of large diameter spruce would be killed if a spruce beetle outbreak occurred. If a beetle outbreak were to occur, most of the larger diameter spruce or lodgepole pine component would be lost within a 5-10 year period.

Recent studies indicate that spruce beetle mortality does not influence the risk of wildfires in the spruce-fir zone unless accompanied by drought (Bebi et al. 2003). Under extreme fire weather conditions, large quantities of dead fuels would contribute to more intense and widespread fire in spruce-beetle killed stands than in unaffected forests (Jenkins et al. 1998; Veblen et al. 1994; Veblen et al. 1991). The cumulative effect of widespread tree mortality also causes dead fuels to accumulate for decades, increasing the hazard of high-intensity fire over time (Arno 1980).

### Alternative 2 – Proposed Action

Alternative 2 would create 115 acres of small openings within the canopy that will enhance spruce regeneration and addressing long-term susceptibility of the spruce component to spruce beetle disturbance. A multi-storied spruce component comprised of various age classes will produce a spruce-fir forest less susceptible to spruce beetle epidemics. The creation of 115 acres of seedling class will begin the process of increasing structural diversity over the long term. Similarly, creation of 85 acres of seedling size class within the mixed conifer type will help maintain diversity over the long term and thereby decrease susceptibility to beetle impacts. Ensuring regeneration of spruce and pine through planting and site preparation for natural seeding within the small openings will ensure that spruce and pine maintain their historic representation in this landscape.

Thinning within the 802 acres, (460 of spruce-fir and 342 of mixed conifer) would reduce the clump basal area and increase the spacing between trees, permitting more sunlight to reach the forest floor stimulating planted and natural regeneration. Thinning will not reduce spruce beetle hazard below moderate (Schmid and Frye 1976), so stands will remain at risk in epidemic situations. However, by thinning the large tree character of the forest may be maintained, while setting up conditions for perpetuation of spruce on the landscape. Assuming future management objectives were similar to those of today, this would be the first group selection entry in a series of entries over a long period of time (150 years or more). As more entries are made, the risk of a beetle epidemic removing a majority of the spruce would be reduced.

Thinning may increase windthrow potential, particularly in sites affected by advance stages of root disease. Although retaining higher basal areas will reduce windthrow potential, the higher basal areas are also more susceptible to bark beetle impacts. Aerial and ground surveys to document beetle activity and tree mortality will continue. Windthrown trees would be removed or treated using other suppression tactics to reduce or prevent beetle population increases. The proposed action is responsive to a Forest Wide Goal under Biodiversity and Viability to reduce potential for insect epidemics.

**Cumulative Effects**

Regeneration and thinning on 1,002 acres of the spruce-fir and mixed conifer forests in combination with the 1,549 acres of regeneration, fires, and thinning in spruce-fir, mixed conifer, and lodgepole pine that were implemented in the past or are ongoing (Coyote Road Hollow Timber Sale) results in bark beetle risk elimination or reduction on 2,551 acres or 33% of the total 7,738 acres of lodgepole pine, spruce-fir, and mixed conifer forest cover types in the landscape. The current mountain pine beetle infestation is killing mature and old lodgepole pine and the end result will be reduced susceptibility to these beetles until younger trees become susceptible. Any future spruce bark beetle infestations or epidemic would subsequently reduce susceptibility to bark beetles since the hosts would be killed and it would take time for host trees to grow to a susceptible size and density again. There are no cumulative effects with grazing since no range lands are being treated.

### Alternative 3

Alternative 3 would have direct and indirect effects similar to Alternative 2, but will reduce the acres of regeneration sites within the project area (148 acres), and will thin fewer acres (589 acres).

**Cumulative Effects**

Regeneration and thinning on 737 acres of the spruce-fir and mixed conifer forests in combination with the 1,549 acres of regeneration and thinning that were implemented in the past or are ongoing results in bark beetle risk elimination or reduction on 2,286 acres or 30% of the conifer forest cover types in the landscape. Effects of the ongoing mountain pine beetle infestation and any future spruce bark beetle outbreaks are similar to those under Alternative 2.

## 3.4.4.3. Noxious Weeds

### Alternative 1 – No Action

This alternative would have no direct effects on noxious weed species. However, weeds could increase in areas that are currently infested and not covered by other ongoing weed management actions. Weeds could continue to be introduced by recreational vehicle use.

### Alternatives 2 and 3

The ground disturbing activities proposed in these alternatives would have a high risk of weed spread in (1) habitats that have high susceptibility to weed invasion or (2) areas that are already disturbed. However, washing and inspection of logging equipment that will be operated off roads (skidders, dozers, and loaders) will be required prior to bringing the equipment onto the Forest. Knutson-Vandenburg (KV) funds will be collected from the timber revenues to fund noxious weed spraying, which would reduce or eradicate noxious weeds and improve the vigor of native vegetation, thereby increasing resistance to further weed invasion. Where KV funds are not available, appropriated funds will be requested. Weed control, both direct herbicide use and non-herbicide prevention measures (vehicle washing), would be included as mitigating measures and would be in accordance with Forest Plan Guideline (G25) to use integrated weed management to maintain or restore habitats for threatened, endangered, proposed and sensitive plants and other native species of concern where they are threatened by noxious weeds or non-native plants. Herbicide treatment of noxious weeds would occur on intermittent service roads, temporary roads, and log landings. Treatments would be commensurate with the location of existing populations and with weed risk. Monitoring would take place to determine effectiveness of treatment. All noxious weed treatments would follow the procedures and mitigation measures outlined in the Revised Forest Plan, Appendix III.

Musk thistle has been recorded near, but not within, proposed harvest units. This species disperses seed primarily by wind. Due to its presence in the project area and the primary mode of seed dispersal, the movement of harvesting equipment and vehicles in and around the harvest units and between units will have minimal effect on the introduction of these weeds to new sites.

The acres disturbed under Alternative 2 are higher than those under Alternative 3 so opportunities for weeds are higher, but weeds would be mitigated under both alternatives by seeding, vehicle washing, monitoring of weeds, and herbicide control. There would be no cumulative effects since weeds would be prevented from becoming established under both Alternatives 2 and 3.

## 3.4.4.4. Old Forest

### Alternative 1 – No Action

Alternative 1 would have no direct effects on mature and old age classes within the project area. Stands would remain in their present condition unless affected by naturally occurring disturbances such as insects, fire or windthrow. The entire 6,196 acres of spruce-fir and mixed conifer within the analysis area would remain primarily in mature and old conditions. Wasatch-Cache National Forest Revised Forest Plan has a goal to maintain or restore as mature and old age classes 40% of total conifer, well distributed across the landscape (Subgoal 3e). Standard S13 states, “at least 20 percent of each forested cover type by ecological section shall be maintained with old forest landscape structure with patch sizes of at least 10 acres. These old forest areas are dynamic, changing location as disturbances occur” Alternative 1 meets this goal. Within the Uinta Mountains Ecological Section outside of Wilderness, about 23,711acres (38%) of the spruce-fir and 45,592 acres (42%) of the mixed conifer type are old forest. Including Wilderness acres, about 53% of mixed conifer and spruce-fir combined are old forest.

Forty two percent of non-Wilderness mixed conifer stands are old forest. The percent of Wilderness mixed conifer stands is more difficult to determine, because the FIA data does not have sufficient plots to do a valid age class analysis on mixed conifer alone. However, of the 89,855 acres of combined spruce-fir and mixed conifer in the Wilderness, 79% are old forest and of the 26,957 acres of mixed conifer that are within the wilderness, very few have been affected by stand replacing disturbances within the past 150 years. Therefore, it is expected mixed conifer and spruce-fir would have similar percentages qualifying as old forest. Forest Plan old forest objectives are exceeded, regardless of the actual acres of mixed conifer old forest in Wilderness. There are 3,426 acres of aspen, aspen/conifer, and conifer/aspen in the analysis area. Very little (88 acres) of this forest type has been treated in the past and so the forest cover of aspen would remain intact, but gradual continued encroachment of conifers would continue to gradually replace the aspen.

An indirect effect of Alternative 1 may be a shift in species composition and structure toward fir and, where aspen is present, mixed aspen and fir stands, as a result of selective mortality of the spruce and lodgepole pine component caused by bark beetles, and potential loss of the large tree character of the current forest. However, stands would retain the mature and old character until natural stand replacing disturbances occur.

## Alternative 2 – Proposed Action

This alternative meets the Revised Forest Plan Standard (S13) for retention of old forest at the Ecological Section scale. Alternative 2 would also develop stand structures that more closely meet Forest Plan guidelines for biodiversity and viability (Guideline G14). There would be more than the desired 40% mature and old conifer age classes and increased representation but still less than the 20% desired for each of the young and mid-aged forest classes. Approximately 115 acres of mature and old spruce-fir and 85 acres of mixed conifer stands would move into the seedling class through harvest and planting of small groups. Thinning of spruce/fir stands on an additional 460 acres and mixed conifer stands on an additional 342 acres would result in a change in the old forest stand structure on a total of 575 acres of spruce/fir and 427 acres of mixed conifer. Overall stand conditions would remain a mature and old forest because of the retention of the larger overstory trees, and the small created openings for site regeneration (1/4 to 2 acres). If group selection harvesting were continued in the future, a multi-storied structure throughout the treated project area would be created, perpetuating the spruce component within the treated landscape. Thinning would reduce the density of the clumps on 802 acres of conifers, but the stands would retain the current large, mature and old tree character. Retention of groups of unthinned trees would provide existing structural diversity and nesting habitat for mature and old forest species such as northern goshawk. Approximately 458 acres of mature and old aspen would be regenerated.

### Cumulative Effects

There has been 932 acres of past harvesting and fire in the spruce-fir and mixed conifer types in the general analysis area that is not included in FIA estimates of current old forest acres on the Uinta Mountains Ecological Section. That in combination with 1,002 acres of treatment in these forest types under Alternative 2 would result in 1,934 acres of treatment in the West Bear landscape. Sixty-nine percent of the analysis area spruce-fir and mixed conifer (6,196 acres) would remain untreated with this alternative. Regeneration of 458 acres of aspen in combination with past harvesting of 88 acres in aspen cover types would result in 556 acres of early seral aspen leaving 84% of the 3,426 acres of aspen, aspen/conifer, and conifer/aspen in mature and old age classes in the analysis area.

From the cumulative effects perspective of the Uinta Mountains Ecological Section, the change is very small. A total of 1,002 acres would be affected under this treatment, but would retain old stand characteristics. Even if all 1,002 acres would no longer meet old forest conditions, it would reduce the existing old forest in the Ecological Section by less than 1% and would meet the Forest Plan standard. Additional timber harvesting and fires are likely across the Uinta Mountains Ecological Section over time, but over that same period of time additional stands will become old forest. Many of the forest stands to the east of the West Bear analysis area are currently 120 to 130 years old.

## Alternative 3

This alternative meets the Revised Forest Plan Standard (S13) for retention of old forest at the Ecological Section scale. Alternative 3 would also develop stand structures that more closely meet Forest Plan guidelines for biodiversity and viability (Guideline G14). There would be more than the desired 40% mature and old conifer age classes and increased representation but still less than the 20% desired for each of the young and mid-aged forest classes. Alternative 3 would have direct and indirect effects similar to Alternative 2, but on fewer acres. Approximately 148 acres of mature and old class would be harvested and planted (small groups). Approximately 78 acres of mature and old spruce-fir and 70 acres of mixed conifer stands would move into the seedling class through harvest and planting of small groups. Thinning of spruce/fir stands on an additional 311 acres and mixed conifer stands on an additional 278 acres would result in a change in the old forest stand structure on a total of 389 acres of spruce/fir and 348 acres of mixed conifer. Thinning would reduce the density of the clumps on 589 acres of conifers, but the stands would retain the current large, mature and old tree character. Approximately 209 acres of mature and old aspen would be regenerated.

**Cumulative Effects**

There has been 932 acres of past harvesting and fire in the spruce-fir and mixed conifer types in the general analysis area. That in combination with 737 acres of treatment in these forest types under Alternative 3 would result in 1,669 acres of treatment. Seventy-three percent of the analysis area spruce-fir and mixed conifer (6,196 acres) would remain untreated with this alternative. Regeneration of 241 acres of aspen in combination with past harvesting of 88 acres in aspen cover types would result in 329 acres of early seral aspen leaving 90% of the 3,426 acres of aspen, aspen/conifer, and conifer/aspen in mature and old age classes in the analysis area.

As with Alternative 2, the effect on old forest within the Uinta Mountains Ecological Section is very small. A total of 737 acres of old forest would be affected, but would retain old stand characteristics. Old forest within the section is well above the Forest Plan goal.

## 3.4.4.5. Threatened, Endangered and Sensitive Plant Species

### Alternative 1 – No Action

Alternative 1 would have no direct effects of threatened, endangered or sensitive species. An indirect effect could occur if habitat is lost as a result of future disturbance such as uncharacteristic fire.

### Alternatives 2 and 3

Alternatives 2 and 3 would have no effects on threatened or endangered species. A survey in the summer of 2005 found a single specimen of *Cypripedium fasciculatum* (Brownie lady's slipper), a Forest Service sensitive plant species. This area along with a suitable buffer has been removed from the proposed treatment area. This action complies with Forest Plan Guideline (G23) to avoid actions on the Forest that reduce the viability of any population of plant species classified as Threatened, Endangered, Sensitive or recommended sensitive. Timber sale contract standard provisions require that if any plants are found during the contract period, they will be reported and all disturbance prevented until the significance or potential significance is determined. The proposed actions will have no impact on the viability of any sensitive plant species, nor will they result in a trend toward Federal listing of any sensitive plant species found on the Wasatch-Cache National Forests (USDA FS 2006). There are no known cumulative effects of past harvesting, fire, or grazing on sensitive plant species.